Examining the short term effects of restoration plantings on emerald ash borer infested flood plains

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Abstract

Emerald Ash Borer (*Agrilus planipennis*) has been identified as present in Ohio since 2003. Since then this small Asian beetle has been devastating to floodplain areas throughout Ohio, killing almost the entire population (99%) of ash trees. In many of these ecosystems, ash was the dominant species in the canopy. The question now remains as how to best repair these areas. In 2011, restoration plots were planted in Clinton Conservation Area (Clinton, Ohio), Oak Openings Metropark (Toledo, OH) and Sharon Woods Metropark (Columbus, OH),

representing a gradient of infestation duration and ash mortality. Three different species were planted randomly throughout the plots, including: pin oak (*Quercus palustris*), American elm (*Ulmus americana*), and sycamore (*Platanus occidentalis*).
The American elms used in the study were generated from a cross between two Dutch elm disease-tolerant American elms. Also, different treatments of deer protection and original planting sizes were used to examine potential differences in survival. The goal of this study is to examine techniques for restoration of damaged flood plains.

Restoration Experiment Planting

American elm, pin oak, and sycamore containerized seedlings were planted in 50 x 50 m restoration plots at each site.

- 3 plots planted with large seedlings on a 6 x 7 m grid
- 3 plots planted with small seedlings on a 2.5 x 2.5 m grid
- 3 species mixed together randomly within each plot
- Half of the large seedlings received deer protection

A total of 3,050 (n=3050) seedlings were planted across all three study sites. At both Clinton and Oak Openings sites three large and three small seedling plots were used. The small plots had approximately 400 seedlings and the large plots had approximately 72-84 seedlings per plot

Research questions

Which variables affect growth and survival of seedlings planted in EAB infested floodplains after 2 years?

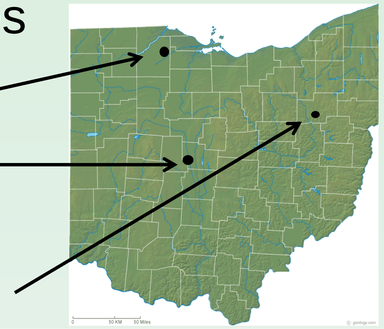
- Species variations in planting of elm, sycamore, or oak
- Initial planting size of large or small
- Presence or absence of deer protection (metal cage)

Experimental Methods

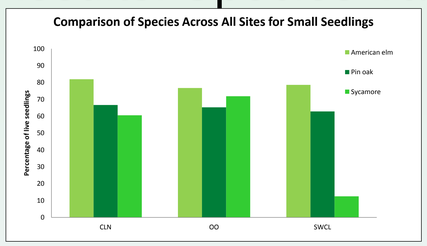
For each tree the height to live growth, condition, percent FIA cover, and the amount of light (densiometer) were taken for each planted tree. After all the measurements were taken and entered into Excel, JMP 10 was used for data analysis. Simple summary data and statistical analysis were used to determine the percent survivorship and standard error.

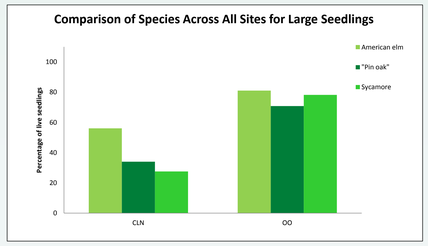
Restoration Sites

- **Oak Openings Metropark**
  - Swan Creek floodplain
  - Almost 0% ash left
- **Sharon Woods Metropark**
  - Spring Creek floodplain
  - Some ash left
- **Clinton Conservation Area**
  - Tuscawaras River floodplain
  - Practically uninfested.



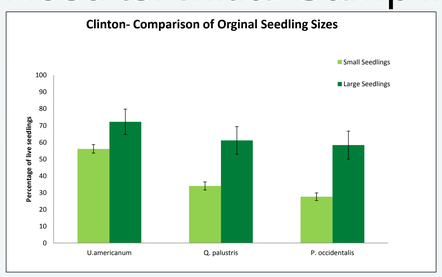
Results: Species Variation

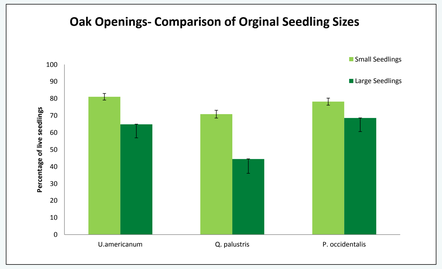




For both large and small seedling size classes elm had the greatest survival ($p<0.001$). Elm survival was 81.9%, 76.7%, and 78.6% across the Clinton, Oak Openings, and Sharon Woods restoration sites respectively. However, some variability was shown across the three sites. Even though American elm did the best, it is still important to note the relatively high survivorship of all three different species.

Results: Initial Sampling Size





At the Clinton site the large seedlings did significantly better than the small seedlings ($p<0.001$). However, at the Oak Openings site the small seedlings did significantly better than large seedlings ($p<0.001$). Knowing the type of floodplains and flood regimes at a site is important.

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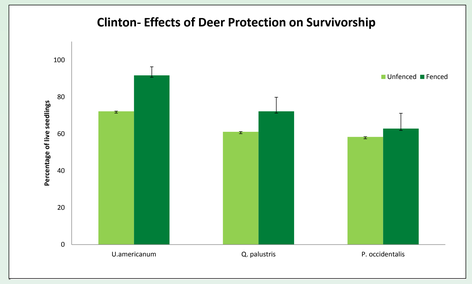
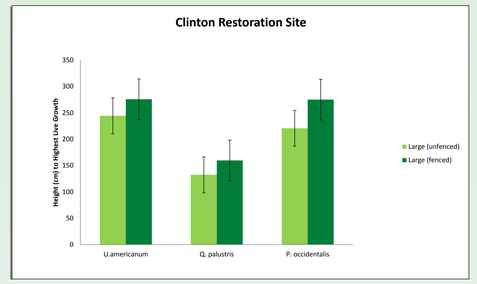
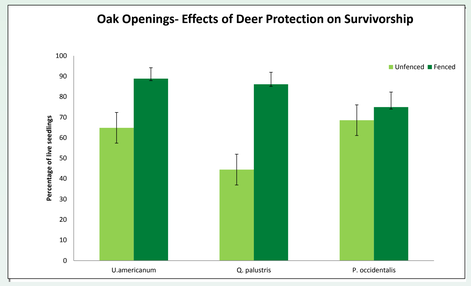
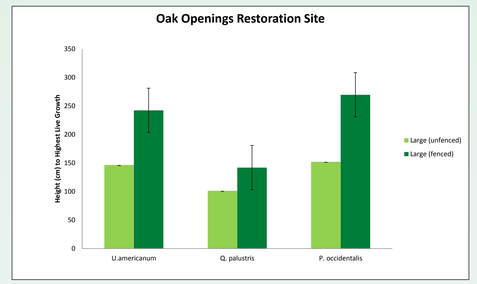
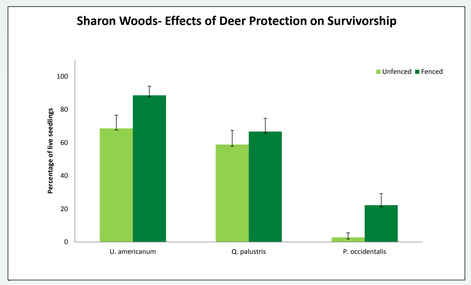
Results: Deer Protection

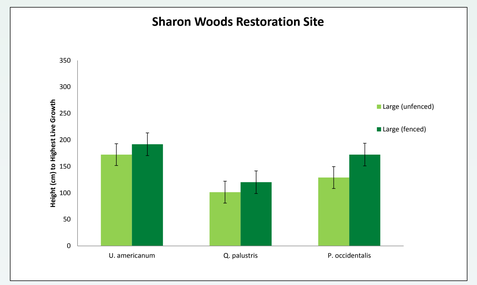












Fencing was only used for large seedling plots only. Fencing has a consistently positive effect across all sites ($p<0.001$) and species ($p<0.001$). Fencing also led to a significant increase in the mean height (in centimeters) to the highest live growth of seedlings for all species ($p<0.001$). There was some variability in both site and species as to the effectiveness of the deer protection. Fencing incurs a cost of about $2.85 per fenced tree and $205.20 per plot of large tree seedlings. In these floodplains there is heavy pressure from deer browsing. On average 48.14% (Clinton), 69.85% (Oak Openings), and 28.96% (Sharon Woods) of live seedlings were impacted by deer.

Summary

This studied examined several variables including species variation, initial size of seedlings planted, and the use of deer protection on survivorship of planted seedlings of the three species planted in floodplains. American elm had the highest survivorship percentage across all three sites to a varying degree. The effect of planting size depended on the site. However, deer protection was found to have the same effect for each site. This was a positive relationship for both survivorship and height. This study will benefit from further cost analysis to see if the use of deer protection is in fact, cost effective.
Implications of this study include: 1) a better understanding of the short term effects of restoration planting, and 2) an understanding of several different dynamics potentially affecting survivorship of seedlings.